

ERDC/EL TR-00-19

Environmental Laboratory



**US Army Corps
of Engineers®**
Engineer Research and
Development Center

An Evaluation of Aquatic Habitats at Edwards Air Force Base, California

Andrew C. Miller and Barry S. Payne

September 2000

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

The findings of this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.



PRINTED ON RECYCLED PAPER

An Evaluation of Aquatic Habitats at Edwards Air Force Base, California

by Andrew C. Miller, Barry S. Payne
Environmental Laboratory
U.S. Army Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Final report

Approved for public release; distribution is unlimited

Prepared for Edwards Air Force Base
Edwards AFB, CA 93524

Contents

Preface	v
1—Introduction	1
Background	1
Purpose and Scope	2
2—Study Area and Methods	3
Study Area.....	3
Methods.....	3
3—Results	7
Overview	7
Description of Selected Habitat Types.....	12
Piute Pond	12
Pond near the sewage lagoon	14
Branch Pond	14
Ephemeral ponds	16
Seasonal Considerations.....	16
Water Quality	16
4—Discussion	18
Value of Selected Habitats at Edwards Air Force Base	18
Major Findings	19
Aquatic Habitats.....	20
References	23
Appendix A: Aquatic Macroinvertebrates Collected at Edwards Air Force Base, California, October 1995, March 1996, and May 1996	A1

SF 298

List of Figures

Figure 1. Aquatic study sites at Edwards Air Force Base	4
Figure 2. Total macroinvertebrate density at four habitats, three sampling dates, Edwards Air Force Base, California	8

Figure 3.	Density of major macroinvertebrate groups at Piute Pond, Edwards Air Force Base, California.....	8
Figure 4.	Density of major macroinvertebrate groups at a pond near a sewage lagoon, Edwards Air Force Base, California.....	9
Figure 5.	Density of major macroinvertebrate groups at Branch Pond, Edwards Air Force Base, California	9
Figure 6.	Density of chironomids and oligochaetes at four locations at Edwards Air Force Base, October 1995.....	10
Figure 7.	Percent abundance of major macroinvertebrate groups in Piute Pond, Edwards Air Force Base, October 1995.....	10
Figure 8.	Percent abundance of major macroinvertebrate groups in Piute Pond, Edwards Air Force Base, May 1996	11
Figure 9.	Percent abundance of major macroinvertebrate groups in Piute Pond, Edwards Air Force Base, March 1996	11

Preface

Personnel at Edwards Air Force Base, Edwards, CA, are conducting floral and faunal surveys to determine the presence or absence of federally listed endangered or threatened species and to obtain information for an overall resource management plan. In the past they have conducted surveys for tortoises, birds, and eubranchipods (including tadpole, clam, and fairy shrimp). This report describes results of a survey for aquatic macroinvertebrates conducted in October 1995, March 1996, and May 1996. Field work, organism identification, and preliminary data analysis were done by Dr. David Beckett and B. Will Green, University of Southern Mississippi, Hattiesburg.

This report was prepared by Drs. Andrew C. Miller and Barry S. Payne, Aquatic Ecology Branch, Ecological Research Division, Environmental Laboratory (EL), Vicksburg, MS, U.S. Army Engineer Research and Development Center (ERDC).

During the conduct of this study, Dr. John Harrison was Director, EL; Dr. Conrad J. Kirby was Chief, Environmental Resources Division; and Dr. Edwin Theriot was Chief, Aquatic Ecology Branch. The point of contact for this work at Edwards Air Force Base was Ms. Wanda Deal.

At the time of publication of this report, Director of ERDC was Dr. James R. Houston, and Commander was COL James S. Weller, EN.

This report should be cited as follows:

Miller, A. C., and Payne, B. S. (2000). "An evaluation of aquatic habitats at Edwards Air Force Base, California," ERDC/EL TR-00-19, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval for the use of such commercial products.

1 Introduction

Background

Edwards Air Force Base is located in the Mojave Desert in southern California near Los Angeles. With the exception of a few permanent ponds, the majority of water bodies at the base are dry during the summer. There are no permanent streams, and playas and most pools have few macrophytes. Terrestrial habitat consists of sand dunes, dry open hills, valleys, dry lakes or playas, smaller claypans, and pools. Vegetation surrounding playas is mainly saltbush scrub and around the pools and claypans is saltbush scrub, Joshua tree woodlands, cottonwood and willow thickets, and mesquite bosque. The uplands are composed largely of creosote bush scrub (Branchiopod Research Group 1993; Pratt 1998).

Although aquatic habitats are limited at the base, they are an important component of ecosystem structure and function at the base. They are a source of water for migrating and local birds and terrestrial animals. Fairy shrimp, other crustaceans, immature insects, and worms live in the ponds and are a food source for other macroinvertebrates, fishes, and birds. Although these aquatic habitats represent a small percentage of available habitat at the base, it is likely that they are of benefit to terrestrial organisms. Availability of water for feeding and reproduction, presence of saltbush shrubs, insect prey of larger predaceous insects, and droppings of vertebrates that drink or feed from ponds probably can all be used by birds, reptiles, and certain terrestrial invertebrates. The habitat value of ponds on Edwards Air Force Base emanates not from an intrinsically rich or rare fauna within them. Rather, these ponds in an arid landscape add productivity, diversity, and complexity that support a rich and possibly rare terrestrial invertebrate fauna that otherwise could not exist.

Edwards Air Force Base personnel are conducting a series of floral and faunal surveys to check for federally listed endangered or threatened species and to obtain information for a complete resource management plan. Previous surveys have been conducted on tortoises, birds, and eubranchiopods (Branchiopod Research Group 1993). An intensive terrestrial invertebrate survey was initiated in 1996 (Pratt 1998). An analysis of aquatic habitats was initiated in 1995 because of the likely importance of these areas to the overall ecosystem.

Purpose and Scope

This report summarizes results of an invertebrate survey of aquatic habitats conducted at the Edwards Air Force Base, California, in October 1995 and March and May 1996. The purpose of the survey was to characterize the fauna of permanent and ephemeral aquatic habitats and to describe their role in the desert ecosystem.

2 Study Area and Methods

Study Area

Qualitative and quantitative samples were collected from Edwards Air Force Base on three separate dates--October 1995, March 1996, and May 1996 (Figure 1). Sampling sites were chosen based upon information provided by personnel at the base and data resulting from a terrestrial insect survey (Pratt 1998). In this report the large, single body of water in the southern portion of the base is referred to as Piute Pond, although it is generally called Piute Ponds by personnel at the base. Although there were islands within Piute Pond, it consisted of a single water body at the time of sampling.

The following habitats at the base were sampled on 5 October 1995 for invertebrates: Piute Pond, a pond near the sewage lagoon, and Branch Pond. On the second collecting trip, 27 and 28 March 1996, the following habitats were sampled for invertebrates: Piute Pond, pond near sewage lagoon, Branch Pond, Scout Road Pond, and four ephemeral ponds on Branch Memorial Road. On the final collecting trip, 29 and 30 May 1996, the following habitats were sampled for invertebrates: Piute Pond, pond near sewage lagoon, Branch Pond, and Scout Road Pond. Global Positioning System (GPS) coordinates for sites surveyed appear in Table 1, and Table 2 summarizes methods used at each location.

Methods

Temperature, specific conductance, and salinity were determined using a Yellow Springs Instruments Salinity-Conductivity-Temperature Meter. All data were collected in the field according to manufacturer's instructions.

A Petite Ponar grab sampler, which samples an area of 232.3 sq cm, was used to obtain quantitative sediment samples. Bottom sediments and the animals they contained were washed into a U.S. Standard No. 30 sieve bucket, which allowed the bottom particles to pass through while retaining the benthic (bottom-dwelling) macroinvertebrates. Sections of whole aquatic plants, or algal mats, were removed using scissors and placed in plastic zip-lock bags. Qualitative samples were obtained from some areas by sweeping a dip net over the bottom and among aquatic plants. All samples were preserved in 10 percent Formalin and stained with Rose Bengal (Mason and Yevich 1967) to facilitate separation of invertebrates from sediments and plant material.

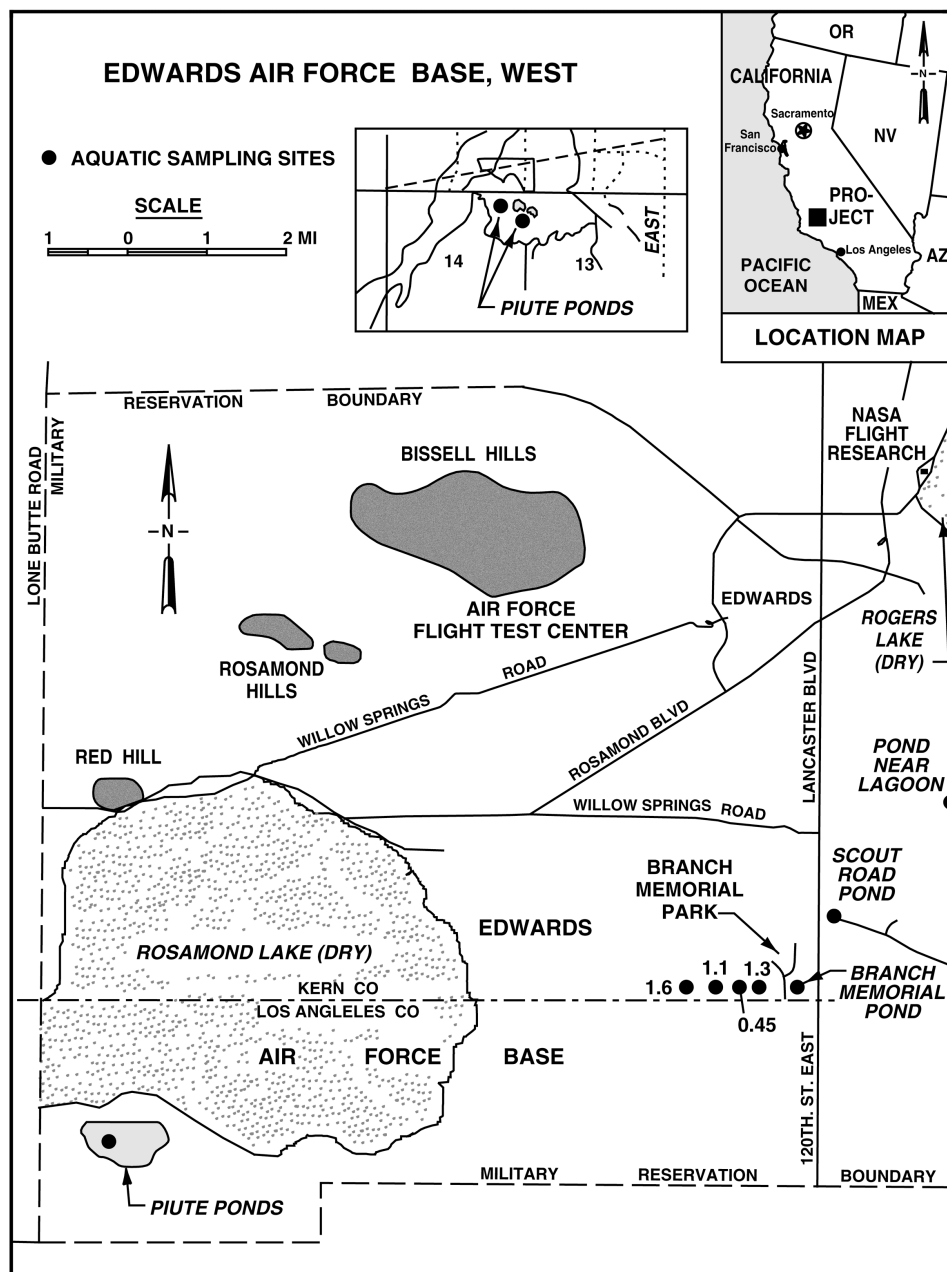


Figure 1. Aquatic study sites at Edwards Air Force Base

In the laboratory, sediments and plant material were placed in white, ceramic-coated aluminum trays. Organisms were removed while the material was viewed with a dissecting microscope at $6 \times$ to $12 \times$ power. After their removal, the oligochaete portion was subsampled, because of their overwhelming presence in many of the samples. The subsampling method consisted of collecting oligochaetes until approximately 100 to 200 individuals were obtained, 3 hr was reached, or the sample was completely sorted. Macroinvertebrates were then preserved in 70 percent ethyl alcohol and held in vials prior to identification.

Table 1
Coordinates Obtained from a Global Positioning System for Sites
Sampled at Edwards Air Force Base, California

Site Name	Latitude (N)	Longitude (W)	Habitat Type
Piute Pond	34.791909	118.108397	Permanent
Pond near sewage lagoon	34.865279	117.881273	Permanent
Branch Pond	34.823645	117.923169	Permanent
Scout Road Pond	34.839572	117.91287	Ephemeral
Pond on Branch Memorial Road, 0.3 mile	34.822894	117.93327	Ephemeral
Pond on Branch Memorial Road, 0.45 mile	34.823045	117.937734	Ephemeral
Pond on Branch Memorial Road, 1.1 mile	34.822851	117.944214	Ephemeral
Pond on Branch Memorial Road, 1.6 mile	34.822701	117.95255	Ephemeral
Note: To convert miles to kilometers, multiply by 1.609.			

Table 2
Location of Samples, Habitat Type, and Method Used for Macro-
invertebrate Sampling, Edwards Air Force Base, 1995 and 1996

Location	Habitat Type	Method	Oct 95	Mar 96	May 96
Piute Pond	Rocks	Hand	x		x
	Middle	Petite Ponar	x	x	x
	Near island	Petite Ponar	x	x	x
	Cattails	Dip net	x	x	x
	Cattails	Cut stems		x	
	Algal mat	Dip net	x		x
Pond near sewage lagoon	Near shore	Petite Ponar	x	x	x
		Dip net	x	x	x
Branch Pond	Near shore	Petite Ponar	x	x	x
	Cattails	Dip net	x	x	x
		Cut stems	x	x	x
Scout Road Pond (Ephemeral pond)	Near shore	Petite Ponar		x	x
		Dip net		x	x
Ephemeral ponds	Near shore	Petite Ponar		x	
		Dip net		x	

Organisms were identified to species level where possible, and dry weights of major taxonomic groups were obtained. Dry weights were obtained by placing known quantities of the organisms in a drying oven at 105 °C for 1 hr, then into a desiccator for 1 hr, and finally weighing to four decimal places using a Mettler analytical balance. Larval chironomids and naidid worms were prepared for identification using the procedure of Beckett and Lewis (1982). The taxonomic nomenclature of Wiederholm (1983) was followed in the identification of larval chironomids. Oligochaetes were identified using the keys of Stimpson, Klemm, and Hiltunen (1985) (for Tubificidae), Hiltunen and Klemm (1985) (for Naididae), and Brinkhurst (1986) (for Tubificidae and Naididae). Branchiopods such as tadpole shrimp, clam shrimp, and fairy shrimp were identified using keys of Thorp and Covich (1991). The rest of the macroinvertebrates were identified using keys of Merritt and Cummings (1996) and Pennak (1989). Appendix A contains a complete list of all aquatic taxa collected at Edwards Air Force Base.